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EAST EUROPE REPORT
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RESEARCHERS ON THIRD GENERATION ROBOTICS DEVELOPMENT

Leipzig LEIPZIGER VOLKSZEITUNG in German 19-20 May 84 p 9 of supplement

[Article by Martin Schroeter: "At the Birth of the ZIM [Central Engineering Enterprise for Metallurgy] Robot"]

[Excerpts] Dr Thomas Grosseohme, group leader for software development (software is in a certain sense the intelligence which is funneled into the robot) at the Leipzig Automation Enterprise of the Central Engineering Enterprise for Metallurgy (ZIM) is the proud father of a robot. Years ago he traded quantum physics, the discipline in which he received his doctorate, for microelectronics, and in 1979 he was given the task of developing robot control software. It was fortunate for him that this job coincided with the start of a comprehensive program by the state to dramatically increase growth of robotics in the GDR.

"At that time we were still at square one," says the 38 year-old comrade today. "Actually we only had the outer steel shell of the robot. We had to start at the very beginning in the development of the control system."

As incredible as it may sound, the first ZIM robot was born in a tent on Rosenowstrasse in Leipzig. As time was short, a "better" birthplace was out of the question. However the lack of "creature comforts" were more of a problem for the robot than they would have been for a human baby; the tent had to be heated considerably because otherwise the robot could not be made to move at all--among other things, the cold oil literally paralyzed its joints.

Nevertheless, development proceeded at an exhilarating pace: In January of 1979, the robot was still in its cradle, and in the fall of the same year the automaton--now freely programmable--was stacking red-hot drawn casings with a weight of up to 45 kg each in the Max metallurgical plant at Unterwellenborn.

The development collective of the ZIM and robot specialists from the light-alloy factory at Rackwitz have been working well together for quite some time. Dr Thomas Grosseohme and Gerhard Froehlich of the light-alloy factory are shown here inspecting work on the sensor-controlled ZIM-60 robot which is being tested in practical applications in conjunction with the shingling rolls [photo not reproduced].

"Grandfather," as Dr Grosseohme affectionately calls the robot, is still operating reliably today in the steel mill at Unterwellenborn. The workers there now fully accept their mechanical co-worker. No wonder, because the machine has taken the heavy work off of the shoulders of the workers, in spite of which they need not fear the loss of their jobs or a wage reduction.

For weavers in Lyon it was a different story. At the beginning of the 19th century they destroyed a loom which was invented by Jacquard and controlled automatically by punched cards because they were justifiably afraid that the invention would rob them of their daily bread. Although the destruction of machines surely no longer occurs, the situation is still basically the same in capitalist factories. Robots are not welcome there because they are preceded by the reputation of being job killers.

The ZIM 60 "grandfather" has been series produced since 1980, and stands up well to international comparison. It was followed by the smaller ZIM 10. Around 300 units of each have since left the factories in Wittstock and Berlin. Dr Grosseohme and his colleagues are currently at work developing sensor systems for the two robot models.

A sensor-controlled robot has been operating reliably in the light-alloy factory at Rackwitz for quite some time, and is used to supply workpieces to one of the large aluminum extruding presses. Around every two minutes the robot lifts an aluminum block weighing 35 kg from a pallet and feeds it to the press. The workers who previously had had to move the blocks to the machine by hand knew at the end of their shift that they had done a day's work.

In this case as well, it was necessary to enable the robot to "see." It can grab an aluminum block only if its gripping arm is placed precisely in the center of the block. The sensors detect the edges of the block and a micro-computer directs the gripping arm to the correct position with an accuracy of one tenth of a millimeter.

The workers in Rackwitz have quickly become good friends with the sensor-controlled robot. Proof of this is the fact that when the robot was down after a repair, the press operator who could have handled the blocks himself put the robot back into service--against regulations. Why should I do all the hard work, he thought, when the robot can do it just as well?

It was many years ago that workers in Rackwitz became concerned when the use of robots was discussed. The first "steel worker" had just arrived from Wittstock. Where should it be put? The first application for the robot turned out to be a technological as well as a management problem: "I can't simply install a robot under any given set of technological circumstances," explained Dr Grosseohme with regard to the problems the people in Rackwitz were experiencing at the time, and which they shared with many others. "In order to use robots effectively, they must be adapted to the technology of the application."

However in Rackwitz these problems were quickly dealt with. A department for microelectronics and robotics was formed which will bring a total of 41 robots into the factory within the five-year planning period. The tasks which will be assumed by the robots primarily involve heavy manual labor and health risks.

Gerhard Froehlich is the head of this department in Rackwitz. The primary motivation for his new activity is its sociopolitical effect: "Making work easier and increasing productivity are important aspects of our economic and social policies, you know. I also find my new work extremely interesting. Maybe the reason is that I have read many utopian books. I find the novelty of robotics intriguing."

Dr Thomas Grosseohme is happy that he has such cooperative contacts in the factories because the workers in Rackwitz are playing a major role in preparing for series production third-generation robots which can "see" and "feel". Such robotics groups in the factories are also sending strong signals, however, in order to pave the way for the introduction of robots into the manufacturing halls. This requires know-how, courage and optimism.

"It will be harder for us in the coming five-year plan," says Gerhard Froehlich of the light-alloy factory. "The easy applications have all been taken care of, and the number of robots will increase."

Greater demands are also being placed on the Central Engineering Enterprise for Metallurgy. The coming five-year plan calls for the manufacture of even more ZIM robots, including third-generation robots. However process automation, according to Dr Grosseohme, shows even greater promise because it allows traditional production methods to be redesigned from the ground up using sophisticated technology and robotics. At the present time one such process automation project is being worked on by the people at the ZIM--also in the Max metallurgical plant. Thus one more page is turned in the book of economic strategy.

And again this is an intriguing task for Dr Grosseohme and his colleagues, who as a collective were awarded the national prize in 1981. These are nationwide tasks which will involve stronger ZIM robots in the future, and the cradle in Leipzig will no longer be entirely adequate.

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CSO: 2302/39

HIGH PRESSURE PHYSICS RESEARCH FOCUSING ON COMPOSITE MATERIALS

East Berlin SPECTRUM in German Vol 15 No 9, 1984 pp 10-11

[Article by Heinz Stiller, Vice President, GDR Academy of Sciences and Heinz Kautzleben, Head, Geological and Space Research, Corresponding Member, GDR Academy of Sciences]

[Excerpts] High-pressure physics, in some instances in conjunction with high temperatures, investigates the effect of high and ultra-high pressures on the states and characteristics of matter. In addition to volumetric compression of the material, high pressure causes changes in the crystalline structure, bonding characteristics and electron structure. In a number of materials these changes occur discontinuously in the form of phase transitions in which the macroscopic characteristics of the materials also vary widely. In international studies, the pressure range used to experimentally investigate these phenomena extends from over 100 MPa to investigation of materials using dynamic pressures of up to several hundred GPa.

At the Central Institute for Geophysics (ZIPE) we have achieved significant advances in the past few years in high-pressure research which became evident in the degree and scope of what was achieved.

In pressure chambers with interior volumes of several cubic decimeters, elastic and thermal characteristics under extreme conditions are determined using electronic measuring procedures at oil and gas pressures of up to 2.5 GPa and temperatures of up to 1000°C. The pressure vs. temperature curves of the transverse and longitudinal speed of elastic waves as well as the experimental determination of the thermal and temperature conductivity of rocks taken from the earth's lower crust and upper mantle have contributed significantly to the interpretation of deep seismic measurements and models of the formation of deposits which we have constructed within the scope of fundamental geological and geophysical research.

High-pressure equipment which can be used to apply forces in specific directions has enabled the investigation of fracture mechanics. We were also able to measure the anisotropic characteristics of rocks which, in conjunction with theoretical models to explain the formation of chasms, fissures and fractures, have supplied fundamental information for use in predicting earthquakes, and which have direct practical value for safety and optimization of underground mines.

Maximum pressures of up to 30 GPa can be achieved by using cut diamonds to apply pressure and by minimizing reaction space. High-pressure research in the field of solid-state physics has added to fundamental knowledge concerning the theory of phase transitions and the compressibility of materials using equations of state, and previously unknown phase changes in semiconductor materials have been experimentally shown to exist. Using light, radiographic and laser methods we have been able to directly observe changes in the matrix structure. The development of pressure chambers in which solid materials are used to transfer pressure makes it possible to perform investigations within pressure ranges of 10 GPa and above, while simultaneously achieving high temperatures of greater than 1000°C. The changes in the solid body under these extreme conditions are generally irreversible, so that in a number of situations measurements are no longer necessary. Our scientific and technical research led to the development and construction of chambers which can handle pressures of up to 8 GPa at temperatures of up to 1800°C.

These chambers are used to carry out petrological investigations on the origins and transformations of rocks and minerals which in turn provide important information about the material structure of the earth's crust and upper mantle. However we are also engaged in fundamental research on industrial problems of materials research.

The permanent change or transformation of materials under high pressures and temperatures as well as the ability to precisely control their characteristics via these processes has been investigated in the ZIPE department for phase transformations in materials, and has led to discontinuities in the speed profiles of locations deep within the earth. We have been able to use catalysts to change the activation energy, the transformation rate and the reaction kinetics of materials. Together with corresponding electronic temperature and pressure control programs, processes were developed which we can use for synthesizing materials.

PHOTO CATIONS

1 Test bench for high-pressure/high-temperature investigation [photo not reproduced]

2 High-pressure/high-temperature chamber for material experiments at pressures of up to 8 GPa and temperatures of up to 1800°C. Developed by the Central Institute for Geophysics, Potsdam [photo not reproduced]

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GERMAN DEMOCRATIC REPUBLIC

ACADEMY OF SCIENCES PRESIDENT ON 1983 ACHIEVEMENTS, NEW STATUTE

East Berlin SPECTRUM in German Vol 15 No 9, 1984 pp 1-4

[Report on speech given by Werner Scheler, President, GDR Academy of Sciences, on the occasion of Leibniz Day in the 35th Year of the GDR]

[Excerpts] "This year's Leibniz Day of the Academy of Sciences of the GDR takes on new meaning in view of the upcoming 35th anniversary of the founding of our republic: The German Democratic Republic is 35 years old, and these have been 35 years of fruitful development in the sciences and 35 years of continued promotion and support of the Academy by the workers and farmers in our republic.

Several weeks ago the Academy had the opportunity to present before the Council of Ministers a report on the activities of the Academy in 1983 and the practical application of the results of its research. In his summary evaluation, the chairman of the Council of Ministers, comrade Willi Stoph, recognized the Academy's great efforts and achievements. However at the same time he also indicated that the existing scientific and technical problems involved in expanding and intensifying the national economy, in production innovation, in realizing our great sociopolitical tasks and in securing the defense of our country require much greater achievements, beginning with basic research."

Disciplinary Acquisition of Knowledge for Comprehensive Research Tasks

With regard to the accomplishments and advances mentioned in the 1983 annual report, the president mentioned factors which stimulate performance growth, among which are increased cooperation over the long term between the Academy and the combines as well as cooperation with the academies of other socialist nations, in particular the USSR. He indicated that it is a constant goal of our research to acquire necessary disciplinary knowledge in comprehensive research tasks dealing with the cornerstones of our social development; especially economic strategy. "In the field of energetics over the past year, this involved primarily continued efforts toward more efficient uses of energy, particularly through optimization of energy-intensive processes and automation of nuclear power plants. One of the ways in which the Academy promoted the development and broad application of microelectronics was through work on new semiconductor materials, hole structures and junction problems, as well as through research on the development of extremely high-density integrated circuits. Efforts to solve problems in information engineering and processing

were also intensified. The scientific conference on the occasion of last year's Leibniz Day was also devoted to this problem. Also worthy of note are the results gained in the establishment of data communications centers as a result of practical cooperation. In the field of materials science, advantages were achieved in testing electrode materials, amorphous materials, dielectric materials, hard alloys and synthesis of mechanically resistant materials. In the area of chemical and biotechnological refinements, production-ready developments were made in the fields of catalysis, pyrolysis, polymers, aromatic compounds, ergotropics and insecticides. For process automation, problems of data storage and image generation for computer-aided workplaces were able to be solved, and preliminary scientific work was expanded in the development and use of sensors and in work on artificial intelligence. Basic research in the life sciences led to microbial process developments for pharmaceuticals and new diagnostic techniques in the field of medicine. The results of research on nutrients and foodstuffs were put into practice in the foodstuffs industry and also were used in establishing diatetic guidelines and recommendations for community nutrition."

Worthy of the work of the plenum and the classes, the president noted that a series of lectures had dealt with areas of extreme interest in the orientation and the determination of position of the scientific development in our country. It had also become a tradition, he said, that classes at the Academy had become involved in existing scientific and technical questions such as in the memorial of the chemistry classes written on the occasion of the manufacture of upgraded fluorine compounds based on our own raw materials, as well as in the joint paper presented by the materials science classes and the construction materials section of the Construction Academy of the GDR with regard to aspects of long-term development of construction materials from our own raw materials.

Significant Results

The president then turned his attention to individual results in different areas of research. In the field of theoretical mathematics, he mentioned the solution to a problem of quantum field theory posed in 1963 by Jost. Based on the solution of an inverse problem in axiomatic access by Wightman and Garding in quantum field theory, it was possible to design interpolating weak local fields for a wide range of dispersion operators. Research into artificial intelligence, the results of which find application in information processing and complex production automation, led to the modeling of the reacquisition and utilization of knowledge from human memory in the Central Institute for Cybernetics and Information Processes, and this information was made available for computer simulation. In terms of intelligence and psychological diagnostics, as well as the technical simulation of processes for understanding speech, these results have practical significance.



4 Using a process of analysis for the determination of trace molecules and elements in ultrapure gases developed at the Central Institute for Physical Chemistry, extremely accurate values could be achieved with regard to purity verification.

Basic knowledge regarding the reduction of material brittleness by initiating microcracks and phase transformations was obtained at the Central Institute for Solid-State Physics and Materials Research, and methods for increasing strength were devised and conditions for increasing the stability of coatings were created for hard alloy and graphite materials. These results can be used for treating the surfaces of metallic materials as well as for developing cutting and grinding ceramics. The president also spoke about highly stable NiCo thin-film resistors developed at the Physical-Technical Institute which are contributing in new ways in the field of microelectronics. They are being used to produce high-grade hybrid circuits for automation systems in the GDR.

In the field of chemical research, Professor Scheler referred to the theory of heterogeneous catalysis developed further at the Central Institute for Physical Chemistry. This theory was used to clarify the bimetallic effect of various metals in catalyzers. These results are also reflected in activity in the field of high-temperature chemistry which clarified the radical mechanisms in the formation of acetylene in a plasma. Preliminary scientific work is essential for the development of high-performance aromatic catalyzers and for the

field of plasma chemistry. Work in the Central Institute for Organic Chemistry on coating technology for photographic materials helped to establish the scientific base for the manufacturing technology used to produce photographic films. Analysis of the interactions between photographic gelatin, surfactants and dye couplers led to clarification of the processes and factors responsible for stability of the overall system.

Work in the geoscience and cosmic science fields concentrated on problems dealing with raw materials and geoecology, research dealing with use of the earth's crust and problems of remote sensing of earthbound parameters. At the Central Institute for Geophysics, precise information dealing with the locations of geological structure zones within the GDR allowed the geological development of this region to be reconstructed; conditions which promote the formation of mineral raw materials can be better recognized and probable accumulations of hydrocarbons better identified. At the same institute it was possible to reliably reproduce the synthesis of artificial mechanically resistant materials, and this information was supplied in the form of technological principles for use in industry in the GDR.

In basic research at the Central Institute for Microbiology and Experimental Therapy in the fields of biology and medicine it was possible for the first time to clone the streptokinase gene from streptococci in the *E. coli* bacterium. This work, emphasized by Professor Scheler, also included establishing the genetic engineering processes and creating functional heterologous producers. In addition, a fermentation process for streptokinase was established. The fact that the GDR has international ranking in the control of plant processes is also due to the work on amino acid sequences in vegetable proteins and initial transfers of animal genes to vegetable cells at the Central Institute for Genetics and Cultural Plant Research.

With regard to the achievements of the social scientists, the president mentioned the analytical forecast study for evaluating the important factors, processes and results of intensification of economic reproduction in the GDR prepared by the Central Institute for Political Economy. The study presents well-founded information on economic development up to the mid-1990's; the study was turned over to the cooperation partner, the State Planning Commission. Long-term research has been and is under way at the Institute for Sociology and Social Policy for promoting the family and increasing the birthrate. In interdisciplinary activities over the past year a comprehensive research report was prepared on the determination structure and the sociopolitical orientations for birthrate development in the GDR in the 1980's. The report was turned over to the party leadership. Representative of many of the activities with regard to the problems of peace as a basic value of socialism, the president mentioned the book entitled "Philosophie im Friedenkampf" [Philosophy in the Struggle for Peace] written at the Central Institute for Philosophy.

A New Statute

The president dedicated a large portion of his speech to international research relations and the effectiveness of cooperation. He defined research

cooperation with socialist countries, particularly with the Academy of Sciences of the USSR, as the core of our international scientific relations. Cooperation regarding questions of energetics, microelectronics, optoelectronics, amorphous materials, surface physics, scientific equipment design, biotechnology, carbochemistry and several other areas was expanded and deepened. Even this brief list, he said, indicates that cooperation was aimed at basic topics which represent the starting point and focus of economic innovation processes.

In the final part of his speech, Professor Scheler spoke about the new statute of the Academy which was confirmed by the party leadership and government, and which took effect on 1 July 1984. The role of the Academy established by the directives of the party leadership is defined in the statute as the center of basic research in our republic. The basic themes of the statute are the higher demands placed on the Academy. The president noted that the statute is defined by two principles of scientific activity: the unity of the sciences and the unity of theory and practice.

The new statute thus defines the Academy as comprising a community of exceptional scholars and capable facilities involved primarily in the fields of basic research and applied research. One of the principle concerns of the statute is to more strongly integrate the activities of this community of scholars and the research facilities. This has proven to be necessary if the Academy is to meet its increased responsibility, above all for the analysis and evaluation of strategic questions of scientific development.

Professor Scheler then informed us that the president, vice president and general secretary of our Academy have been returned to their positions for the next four-year term by the chairman of the Council of Ministers, who in doing so followed the recommendation by the plenum of full academy members passed on 14 June 1984 (see page IV). At their own request, full members Hermann Klare and Heinrich Scheel were relieved of their posts as vice presidents and they were thanked by the government for their many years of leadership in the Academy, appreciation echoed by Professor Scheler.

PHOTO CAPTIONS

1. p 2 Using the "ANNET" system for large-scale electric circuits developed by a working group at the Institute for Mathematics, it is now possible to perform computer analyses for the development of structural components using significantly less memory, at higher speed and for considerably more complex networks.
2. p 3 At the Central Institute for Inorganic Chemistry it was shown that two secondary materials used as additives in the cement industry inhibit the destructive alkali reaction in concrete. Our photo shows a pressing tool used to force out the aqueous phase present in the concrete pores in order to investigate its alkali hydroxide content as a function of specific additives.

3. p 3 At the Central Institute for Electron Physics, prototype production of high-quality Schottky diodes was started.
4. p 3 A sample slide developed jointly by the equipment design section of the VDE Berlin-Buch and the Center for Scientific Equipment Design is used at the Central Institute for Nutrition to analyze toxic substances in rape seeds.

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FLEXIBLE MANUFACTURING SYSTEM CONCEPT FEATURES CACHE MEMORY

Halle FREIHEIT in German 19 Oct 84 p 8

[Article by Gerhard Stehfest]

[Excerpts] Claus-Dieter Sieg, a development technologist in the VEB Zemag Zeitz, is at his best when working with things which the lay person finds confusing or incomprehensible. He can be found in the robot design section of the enterprise, where technology is put into practice through the use of microelectronics. Mr. Sieg, a nearly 30-year-old degreed engineer, works long and hard together with the technicians on the most difficult tasks.

He is currently working on such important research and development projects as the adapting control for the ZIS 995 peripheral rotating and pivoting device, the adapting and measurement control for the IR 2/ sII industrial robot and the control for a complete system for the manufacture of wheels for crawler swing-boom cranes. "In this application," says Claus-Dieter Sieg, "the design and installation of the entire system, which comprises a ZIM 60 industrial robot, three machines and an automatic buffer memory, is not enough. In this case--and this should be the task of every researcher, developer and technologist--the entire periphery must be analyzed in order to achieve the best results."

Already he is working on a way to ensure that the process control, which comprises 500 inputs and around 4000 program steps, can be quickly repaired in the event of a malfunction, whereby a microcomputer can be used to monitor the entire system, immediately diagnose the problem and display the malfunction on the maintenance technician's monitor. This comprehensive solution will allow five workers to be reassigned to other tasks.

Claus-Dieter Sieg is a state-of-the-art engineer. For him, patent applications are an integral part of his work. He has already submitted three patents in the VEB Zemag, and two more at the technical university in Dresden where he is currently writing his dissertation. As the director of a young researchers' collective, he considers it important to guide his younger colleagues along the path of invention, paying particular attention to their participation in young inventors competitions. Together with his young researchers' collective he is working on an analysis of the various applications for microelectronics, with the goal of submitting at least one patent.

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BRIEFS

400 COMPUTERS FOR USSR--Dresden (ADN). The 400th electronic data processing system produced for the USSR was now delivered according to contract by the VEB Combine Robotron to the Soviet partner. The computer of the type "EC 1 055 M" will be employed in the USSR State Bank for further automation of processes of the financial system. The data processing machine reaches a speed of 450,000 operations per second and belongs to the family of the uniform system of electronic computer technology (ESER). The "EC 1 055 M" system is the principal product of the Robotron-Combine. The computer can be coupled with peripheral equipment from other RGW countries.

EDP technology from the combine Robotron has proven itself for over ten years in the USSR, for instance in the United Nuclear Research Institute in Dubna, in the Institute for Cosmic Research, in the sphere of the Ministry for the Crude Oil Industry, in the automobile factory on the Kama, and in numerous other enterprises and installations of the national economy. [Text] [Dresden SAECHSISCHE ZEITUNG in German 17 Oct 84 p 2] 12693

SENSOR-CONTROLLED ROBOT DEVELOPED--Although it has no eyes, it can see--the welding robot from the VEB Pipe Combine Riesa. It owes its sight to the youth brigade "Eugen Lacour" from the steel and rolling mill Riesa which developed a sensory analysis for it, with which it introduced itself recently as one of the top exhibits at the 26th District Fair of the Masters of Tomorrow. What can the sensor-controlled robot actually do? By detecting reflective differences in the material, it recognizes small parts as well as edges of larger three-dimensional parts in the plane, without making contact with them. The located search point is in this case identical to the starting point of the welding seam up to less than half a millimeter. The advantage lies in the fact that the robot also can be used for very short welding seams. The sensory analysis makes it possible, however, to do still more, for the welding robot represents only one specialized case of employment. It is conceivable, for instance, that an industrial robot of the textile line equipped with this sensory analysis will find the spot in the material in which a rivet must be inserted. The development of the innovation described provides proof that an exchange of experience and collective work pays. Skilled workers and engineers of the steel mill alone could not have accomplished this development so rapidly. There was, for instance, a lack of specific components. Robotron Dresden helped by making available radiating elements. The result speaks for itself: The exhibit received the trophy of the Chamber of Technology. U.P. [Text] [Dresden SAECHSISCHE ZEITUNG in German 12 Oct 84 p 3] 12693

CAD, CNC STUDIES CITED--Computer models of complicated processes prove increasingly to be an informative aid in scientific studies. The modern computer technology makes it possible today, for example, to "play through" or simulate within minutes several days of operation of a still nonexistent elevator in a high-rise building, and to determine thereby the most favorable of the various types of construction. The user of this simulation method establishes contact with the computer or "elevator model" by way of the keyboard and screen. A prerequisite for the success of the experiment is the prior programming of data on the normal functional sequence, user habits, and even malfunctions and other irregularities. Scientists and students at the Magdeburg Technical University "Otto von Guericke" are engaged in such research. They are using this still very new method in a simulation office of the departments Computer Technology, Data Processing, and Machine Construction for the purpose of analyzing such technological industrial processes as transport, transshipment, and storage. Their findings serve in many cases the planning of new facilities. The experiment by means of the computer model is used moreover for the testing of the capacity of automatic controls existing for the present only on the drawing board, and for determining suitable variants for the assembly of data banks. [Text] [Schwerin SCHWERINER ZEITUNG in German 5 Oct 84 p 3 of supplement] 12693

PLASTICS WELDING, MATERIALS RESEARCH--Scientists of the Department for Materials- and Processing-Technology at the Technical University Merseburg are presently engaged in research on the conduct of plastic materials during welding. They want to determine how the effect of the high temperature and pressure occurring during the welding process will change internal structure of the polymeric materials. As Dr. Volkmar Horn, the head of the research group advised, this will affect the properties and thus the constant quality of the welded joints. He stated, "If formerly the opinion prevailed to change the internal structure, i.e., the morphology as little as possible during welding, we have now come to the conclusion that a specific change of morphology will result in improved characteristics, especially with regard to the durability of the material." Furthermore, the Merseburg scientists conduct research on the weldability of new morphase polymer materials. In order to weld them securely, the processing technology has to be influenced already during the development of the materials. The research work conducted in Merseburg is part of a close cooperative work within the RGW coordinating center for welding technology. About 200 scientists from five countries participate in work on the subject "Plastic Welding" coordinated by the center under the overall control of the Central Institute for Welding Technology in Halle. A matter of concern is the development of technologies and equipment for all welding processes in order to increase first of all the productivity and to save in materials and energy. The contractually settled cooperation extends to joint new developments of equipment and technologies, as well as the drafting of binding technological and test guidelines. A catalog of plastics welding equipment produced in the RGW is the result of many years of work. bwt [Text] [East Berlin NEUE ZEIT in German 16 Oct 84 p 6] 12693

EC 1055 M COMPUTER--Received on Friday, Werner Eberlein, a member of the Central Committee and first secretary of the District Headquarters Magdeburg of the SED, presented a new large computer of the type EC 1055 M to a youth collective in the VEB Data Processing Center Magdeburg. During a tour of the enterprise,

accompanied by Heinz Herzig, the secretary of the district headquarters, he informed himself on the numerous possibilities of increasing output which the modern computer technology opens up for all areas of the economy. The new computer from the ESER system is distinguished by its high capacity. It can process six to seven programs at the same time and has at its disposal a fund of about 1.7 billion characters stored on magnetic disks the size of a breakfast plate, but thinner. The information contained on such a plate would fill about 50,000 typewritten pages or, with punched cards placed next to each other, extend over a distance of 3.5 km. All these data are available within milliseconds from a computer unit taking up no more space than two three-door clothes or linen cabinets. That is half the area taken up by the predecessor system. Far in excess of 100 enterprises and installations have their computing and projections done here, receiving important information for their designs and constructions. Thus, the production of the 4000-plate works is controlled for some time now by the data processing center. Economic projects are delivered for the entire production process of the "Wilhelm Pieck" steel foundry in the northern part of Magdeburg. The technological preparation for the production is gaining increasing importance by means of the computer. The Data Processing Center and the VEB Power Plant Construction Magdeburg refer in this regard to their satisfying experiences. The enterprise gets data for computer-assisted designs and for the preparation of the production. [Text] [Magdeburg VOLKSSTIMME in German 13 Oct 84 p 1] 12693

OPTICAL PRESET DEVICE FOR CNC-MACHINE--Triptis. A mechanical, optical preset device for the DS 2 and DS 3 CNC 600 lathes has been developed in the VEB Plastunion Triptis. The device makes it possible to read off the respective tool constants of the X and Z axis by observing a constant value. The setting accuracy is increased from 0.2 mm to 0.02 mm. The measured value is displayed on a screen and can be read into the program immediately. An additional correction of tool/machine is not required. [Text] [Dresden SAECHSISCHE ZEITUNG in German 15 May 84 p 3] 12693

WELDING ROBOTS APPLICATION DESCRIBED--Robots are increasingly taking over the time-consuming, expensive and hard work of welding in industrial plants. A research collective of the Central Institute for Welding Technology of the GDR in Halle under the leadership of engineer Gerhard Schermer has developed since 1977 the ZIS 995 construction kit for the assembly of welding robots, a top-notch product in this field. These building units make it possible to assemble robots for the most varied welding tasks and processes. Two hundred robots have been placed in operation to date in industrial plants with great success. Up til now their use resulted in economic benefits of eight million marks. Twenty to 30 robots are added annually due to the fact that series production was begun at the VEB Construction Machinery in Halle. The main emphasis of further research lies in an automatic feed, resulting in increased efficiency and serving to free still more workers for other tasks. The latest product, the arc welding robot RI 6, was introduced by the Central Institute for Welding Technology (ZIS) to domestic and foreign visitors at the Leipzig Spring Fair 1984. A total of 12 patent applications were filed during the development of the construction kit ZIS 995. One member of the development and introduction collective received the national award for this successful work of many years, while another member was awarded the honorary title of "Inventor of Outstanding

Merit". Fourteen members of the collective were awarded the banner of labor.
[Text] [Dresden SAECHSISCHE ZEITUNG in German 28 Sep 84 p 5 of supplement] 12693

CENTER AIDS ROBOTICS APPLICATION--Experiences gathered with robots in the construction of heavy machinery and plants in the GDR are collected and made available by the Scientific-Technical Center of this branch of industry in Magdeburg. Engineering collectives of the VEB Research, Development and Rationalization of Heavy Machinery and Plant Construction have made it their task of working out solutions of principle in typical examples for the utilization of robots--among other things for the feeding of lathes, solutions which can be used subsequently with high economic effects. They help realize automation projects more quickly and efficiently. Studies and practical examples have proven that the time until a robot is employed can be shortened by one-third with the aid of the thoroughly tested project variants from Magdeburg. In addition, the experiences of creative work gathered here conform to the most modern state and guarantee high efficiency. The solutions of principle are worked out on the basis of selected cases of use in enterprises, such as the SKET or the Armatures Combine Magdeburg and are perfected further by studies in the test field of the research facility. Many partners in practice have already informed themselves at a consultation bureau of the Chamber of Technology or acquired documentation on the use of robots. These documents contain among other things the technological project, program material, operating instructions, demands on the information process, findings pertaining to industrial science, and recommendations regarding the performance evaluation of the operators. [Text] [East Berlin NEUES DEUTSCHLAND in German 27 Aug 84 p 3] 12693

REVERSE CYCLE HEATING SYSTEM--The first heat pump of the Technical University Dresden was put in operation at the department of hydroscience, where it uses the groundwater directly at the site of installation. A water quantity of about two cubic meters per hour with a temperature of nine to ten centigrade is taken from a drilled well. The water is cooled in the heat pump by about four degrees centigrade and returned to the groundwater through a second well. The dimensioning of such withdrawal/infiltration systems was the subject of a dissertation. It was thus possible to gather practical experience with this heat pump and at the same time to introduce design fundamentals quickly to practical application. The pump with its rated capacity of twelve kilowatt is used for heating of a new workshop building. Four rooms are connected to the heating system, in which both plate-type radiators and floor-heating may be installed. This new installation is said to permit savings of more than 16 tons of crude lignite in one heating period. [Text] [Dresden SAECHSISCHE ZEITUNG in German 28 Sep 84 p 5] 12693

NEW WATER PURIFICATION SYSTEM--Power plant ash has proven to be an economically and chemically beneficial agent for the subterranean treatment of acidic and chalybeate groundwater in open-cut lignite mines. This water can subsequently be conditioned at relatively minor cost so as to be suitable as drinking and utility water. Respective studies were conducted by the joint research group "Open-Cut Drainage" of the Brown Coal Power Plant Senftenberg and the Technical University Dresden. The results--for which patent applications have been filed--have already been confirmed by laboratory tests. With the introduction of the new process, the contamination of the water will be substantially reduced and

and the costs for its reconditioning decline. The operation of filter wells dug in the open-cut mines for drainage also becomes more reliable and less expensive because they are no longer obstructed by weathering materials. [Text] [East Berlin BERLINER ZEITUNG in German 6-7 Oct 84 p 13] 12693

ELECTRON-BEAM WELDING MACHINE--For the first time, the highly productive electron beam welding can be used for welding metal parts in the machine tool manufacture of the GDR. The plant was designed and built by the Research Institute Manfred von Ardenne in Dresden. It is equipped with a robot which takes care of the feed and removal of the parts on the inside. M 300,000 are saved annually by their use in the parent plant of the Fritz-Heckert-Combine. [Text] [East Berlin BERLINER ZEITUNG in German 30 July 84 p 3] 12693

CSO: 2302/40

HUNGARY

ES DEVICES AT FAIR

Budapest SZAMITASTECHNIKA in Hungarian No 10, Oct 84 p 3

[Article by Dr Zoltan Szabo: "Device Supply"]

[Text] In our July issue a number of articles reported on new items at the spring Budapest International Fair this year. This article will try to recall the fair once again from the viewpoint of the ESR [Uniform Computer Technology System] products exhibited.

We might get an incorrect picture of the results achieved by the socialist countries within the framework of the ESR if we paid attention only to the spring Budapest International Fair this year. Fair participation and the composition and volume of products exhibited did not nearly express the achievements of the research and development taking place in the socialist countries.

In addition to the domestic exhibitors, Poland had the most "live" equipment, but this was not exactly new, for the ES 9150 Mera grouped data preparation system is already in operation even in our country. The smaller member of the D-100 and D-200 matrix printer family figures in the ESR with code number ES 7189. The chief technical characteristics of this are:

--printing speed: 100 characters per second (in the case of 10 characters per inch), 165 characters per second (in the case of 16.5 characters per inch);

--number of characters per line: 80 (in the case of 10 characters per inch), 132 (in the case of 16.5 characters per inch);

--the characters are made from a 7 x 9 point matrix;

--the character set can vary from 64 to 256;

--interface: Logabax (standard), Centronics and V.24 as options;

--dimensions: 410 x 320 x 120 mm; weight: 12 kilograms;

--preliminary price: around 2,000 rubles (according to information from the Polish foreign trade enterprise Metronex).

The larger member of the printer family is the D-200, which differs from the D-100 primarily in its higher printing speed. The preliminary price of this is 7,000 rubles (source as above), which suggests that the Poles have only now begun manufacture. (At last year's Budapest International Fair the price of the D-100 printer was still 4,800 rubles.)

The RTDS-8 real time development system developed by a unit of the Polish Academy of Sciences does not belong directly to the ESR, but as a tool for design it could help the development of the ever more widespread professional personal computers in the ESR too.

The system consists of two main parts:

- a basic microcomputer (8085 processor, 16 K RAM, 8 K EPROM),
 MERA 7952 display, which is also the system console,
 floppy disk store,
 DZM-180 printer,
 punch tape peripherals (CT-200 reader, DT-5 punch), and

- a universal emulator for 8 bit processors.

The software also can be divided into two larger parts:

- system monitor, and

- disk operating system with program library (compatible with the CP/M 1.4 version).

The applications program library contains, among other things, an 8080/8085 assembler, ASM, TBASIC, MBASIC and FORTH interpreter and emulation control and test programs.

At the Soviet exhibit they displayed in real equipment form the 200 M byte exchangeable magnetic disk subsystem, which consists of an ES 5580 control unit, an ES 5680 control module and an ES 5080 exchangeable magnetic disk store. The subsystem can be used in configurations of ESR models which have the standard ESR I/O interface and which can provide data traffic at a speed of 775-824 K bytes per second over a block multiplex channel. Four channels can be connected to the control from one direction, while from the other direction one can connect either a maximum of eight stores directly or a maximum of three control modules, to each of which one can connect eight stores (a total of 24 stores). The capacity of the ES 5080 store reaches 200 M bytes, by virtue of doubling the band density of the ES 5066 store already widespread among users. The disk pack has 19 work surfaces and one servo surface. The maximal linear writing density of the disk is 160 bits/mm. The average access time is 45 ms.

They also displayed in an autonomous operating mode the ES 7036 alphanumeric printer. The printer can be connected to the multiplex or selector channel of ESR series I and II computers operating with the OS 4.1 or later operating systems in the multiplex or monopol (burst) mode. The speed of the printer is 800 lines per minute plus or minus 10 percent with 132 characters per line

and an 84 character set per position. The printer prepares a maximum of 5 copies with perforated paper 180-420 mm wide.

Among the complete computer models now offered for delivery by ELORG they displayed in mock-up form the ES 1061, a further developed version of the ES 1060 computer. Among the unique features of the computer one should mention that it is intended primarily for systems use. The multiplex devices of the model make possible the efficient combination of the resources of several computers to solve common tasks. The connection between the several models can be realized at the following levels:

--at the level of the channels with the aid of a channel/channel adapter;

--with use of common stores; or

--at the level of the processors with the aid of the devices for direct control.

It is also possible to create a two processor system with a common storage field.

The arithmetic instructions processing 128 bit floating point operands provide more precise floating point calculations. The 2-8 M byte operating memory can be expanded by software means into an 16 M byte virtual memory. Compared to the ES 1060 model the diagnostic system is more perfected and the reliability has increased.

The ES 1061 can perform 1.5 million operations per second and its channel throughput capacity is 10.5 M bytes per second. One can run a maximum of 15 programs on the machine simultaneously. Software support for the model is provided by the ESR/OS operating system and a broad range of applications programs.

The other model offered for delivery was the ES 1045.01. The ES 1045, which belongs in the second ESR series on the basis of its performance--650,000-800,000 operations per second when solving scientific-technical tasks (GIBSON-III) and 530,000 operations per second when solving designing and economic tasks (GPO-WU-II)--can be included among the medium computers. In addition to the applications areas characteristic of this computer category, the matrix processor which can be connected to the computer via a special interface significantly increases the efficiency and speed of the ES 1045 in certain applications areas--image processing, processing geophysical data, solving mathematical and other specific tasks. The speed of the input/output channels of the computer (totaling 5 M bytes per second) makes possible the connection of a wide variety of the most varied peripherals. An operating memory which can be expanded from 1 to 4 M bytes, a virtual memory of 16 M bytes and an expanded instruction set (183) are available to users for efficient task solution. In order to accelerate execution of certain arithmetic and logical operations one can find in the processor a special block accelerator in which one can execute multiplication, binary-decimal transformation, sorting operations, basic stepping operations and certain writing in

and rewriting operations into memory. The machine runs under control of the ESR/OS operating system. In the event of multi-programming one can run a maximum of 15 user programs simultaneously in the MFT nad MVT mode while the number of programs which can be run in the SVS mode is unlimited.

The peripherals already known in the ESR fit the basic configuration of both models (ES 1061 and ES 1045).

Among its ESR products, Bulgaria brought its 200 M byte exchangeable magnetic disk store (ES 5067), the development of which was completed in 1980. In addition it exhibited the IZOT 1016 C universal minicomputer which does not belong to either system--ESR or MSR--which was made to solve tasks which cannot be solved with microcomputers but which cannot be solved efficiently with larger--ESR--computers either. Its central unit is built on a 16 bit microprocessor and its operating storage capacity can be expanded to 128 K bytes from 4 K byte modules. With the aid of an intersystem adapter the IZOT 1016 C can be connected to the selector or multiplex channel of ESR models.

Romania is participating in ESR development primarily in the area of remote data processing equipment and so-called continual writing (streaming) magnetic tape stores. At the Budapest International Fair they exhibited the M216 desktop computer of the Felix family, already known earlier. The central unit is built on an 8086, 8080A microprocessor and it has RAM up to 1 M bytes and a 32 K byte EPROM store. The operating systems are CP/M0 and SFDX (compatible with ISIS).

The GDR and Czechoslovakia did not bring computer technology devices to the spring Budapest International Fair. As already reported, Robotron demonstrated its new products at a special exhibit held in Miskolc in May.

I would like to mention the domestic ESR products only by listing them since a number of reports about them have appeared already.

Videoton and the SZKI [Computer Technology Coordination Institute] displayed ESR computers; Videoton a further developed version of the ES 1011, the ES 1011M, and the SZKI the Proper-8 (ES 1800) and the Proper-16 (ES 1830) professional personal computers. The MOM [Hungarian Optical Works] paraded its floppy disk family, the newest member of which is a half-height, 1 M byte capacity minifloppy store (ES 5323). In the area of peripherals the Telephone Factory offered users its TAP-34 intelligent terminal, with the ES 8534 code number, Orion offered its ES 8007 modem with a speed of 1,200 bits per second and Videoton offered its ES 8566.01 group programmable display terminal developed by the SZKI.

8984

CSO: 2502/10

HUNGARY

SPECIFICATIONS OF BLOC FLOPPY DISK DRIVES

Budapest SZAMITASTECHNIKA in Hungarian No 10, Oct 84 p 5

[Table compiled by Attila Kovacs: "More Important Characteristics of Domestic and Socialist Floppy Disk Drive Units"]

[Text] In our table we compare primarily the characteristics of drive units for those floppy disk stores which can be connected to micro and minicomputers, all those manufactured domestically and the more important of those which have been tested in the ESZR [Uniform Computer Technology System] and which can be obtained now within the socialist sphere. We should note that a large part of the drive units tested in the MSZR [minicomputer system] and now obtainable within the socialist affiliation are identical with those with ESZR code numbers and we intend to present a tabular compilation of these in a later issue. The data given in the following table come from the domestic manufacturers, and in part from the importing foreign trade enterprise; they show the situation at the end of June 1984; the prices are for informational purposes only.

Típus (ESZR kódjának)	Gyártó (ország) forgalmazó/importőr	1) MOM/ MIGERT	2) MOM/ MIGERT	3) MOM/ MIGERT	4) MOM/ MIGERT	5) MOM/ MIGERT	6) MOM/ MIGERT	7) MOM/ MIGERT	8) MOM/ MIGERT	9) MOM/ MIGERT	10) MOM/ MIGERT	11) MOM/ MIGERT	12) MOM/ MIGERT	13) MOM/ MIGERT	14) MOM/ MIGERT	15) MOM/ MIGERT	16) MOM/ MIGERT	17) MOM/ MIGERT	18) MOM/ MIGERT	19) MOM/ MIGERT	20) MOM/ MIGERT	21) MOM/ MIGERT	22) MOM/ MIGERT	23) MOM/ MIGERT	24) MOM/ MIGERT	25) MOM/ MIGERT	26) MOM/ MIGERT	27) MOM/ MIGERT	28) MOM/ MIGERT	29) MOM/ MIGERT	30) MOM/ MIGERT	31) MOM/ MIGERT	32) MOM/ MIGERT	33) MOM/ MIGERT	34) MOM/ MIGERT	35) MOM/ MIGERT	36) MOM/ MIGERT	37) MOM/ MIGERT	38) MOM/ MIGERT	39) MOM/ MIGERT	40) MOM/ MIGERT	41) MOM/ MIGERT	42) MOM/ MIGERT	43) MOM/ MIGERT	44) MOM/ MIGERT	45) MOM/ MIGERT	46) MOM/ MIGERT	47) MOM/ MIGERT	48) MOM/ MIGERT	49) MOM/ MIGERT	50) MOM/ MIGERT	51) MOM/ MIGERT	52) MOM/ MIGERT	53) MOM/ MIGERT	54) MOM/ MIGERT	55) MOM/ MIGERT	56) MOM/ MIGERT	57) MOM/ MIGERT	58) MOM/ MIGERT	59) MOM/ MIGERT	60) 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Description of Table:

The column headings give the name of the manufacturing enterprise, if Hungarian, or the name of the manufacturing country, if not Hungarian, and, after the slash, the name of the Hungarian enterprise selling or importing the item:

Key:

- (1) MOM [Hungarian Optical Works]
- (2) MIGERT [Instrument and Office Machine Marketing Enterprise]
- (3) BRG [Budapest Radio Technology Factory]
- (4) METRIMP=METRIMPEX [Instrument Industry Foreign Trade Enterprise]
- (5) BNK [Bulgarian People's Republic]
- (6) LNK [Polish People's Republic]
- (7) CSSZK [Czechoslovak Socialist Republic]
- (8) NDK [German Democratic Republic]
- (9) OR
- (10) Forints
- (11) Rubles

Capitalist export only in 1984.

- a) Model (ESZR code number)
- b) Disk diameter (inches)
- c) Number of information surfaces
- d) Maximum capacity (per disk, unformatted, M bits)
- e) Transmission speed (K bits per second)
- f) Access time (ms): band to band
 time to come to rest
 time to lower head
- g) Band density (bands per inch)
- h) Number of bands
- i) Coding mode
- j) Dimensions (mm) (length x width x height)
- k) Weight (kp)
- l) Price

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CSO: 2502/10

HUNGARY

MOM PERIPHERALS

Budapest SZAMITASTECHNIKA in Hungarian No 10, Oct 84 pp 1, 5, 7

[Article by Karoly Molnar, chief engineer, Hungarian Optical Works: "Computer Technology Peripherals in the Hungarian Optical Works," from a speech given at a conference in Zalaegerszeg]

[Test] The Hungarian Optical Works (MOM) began large series manufacture of computer technology peripherals in its Budapest plant about 15 years ago and 10 years ago it established a factory in Zalaegerszeg for this purpose.

The production volume for computer technology peripherals has taken on a determining character among the products of the MOM in the present plan period, making up 25-35 percent of all production. In the first 2 years of the plan period its share in total production decreased somewhat compared to the earlier period, then increased vigorously, and the growth continues at present. The share this year is 35 percent. The reason for the growth is primarily that series manufacture of floppy disk drive units began at the beginning of the plan period, and this met with a general increase in computer technology demand for storage devices.

Accordingly we are producing ever larger numbers of the Diszkmom family, which already can be called traditional. The annual combined trade value for computer technology products is between 800 million and 1.2 billion forints. The products are almost exclusively magnetic storage devices.

Since the increase in demand for floppy disk drive units was faster than the increase in production, the satisfaction of demand has stabilized. The explosive spread of personal computers which has taken place recently contributed to this in large measure also. Only competition can influence a further increase in demand. But at present market undersaturation is still characteristic of the socialist countries.

The Winchester disks represent the type that will replace our Diszkmom equipment. Although there are no signs of this yet; indeed, it is the aspiration of our partners to cover their increasing needs by increasing the annual quotas. It follows from this that we need not count on a reduction in the production of our Diszkmom equipment in the Seventh 5-Year Plan period. At present 95 percent are shipped to domestic or socialist markets.

There are partly technical and partly economic reasons for the growth in capitalist export. The present cost level of the products does not make them competitive on the capitalist market. According to our experiences an acceptable price level would be lower than the direct material costs (so this is not simply an enterprise category). The capitalist import fraction of the products is 5-6 percent.

The economicalness of manufacture of the product group is average in our product structure. Profitability varies by products and marketing direction. We feel that the economicalness can be developed, although we are counting on a certain reduction in prices also.

Taking into consideration the limits on available developmental capacity we are conducting development concentrated in a narrow spectrum. Since the solution of tasks given out to outside research and development sites is not always satisfactory the developmental throughput time is longer than it should be.

We consider the so-called following distance, calculated from first appearance, to be characteristic of our products. This developed as follows for our chief devices:

<u>Year</u>	<u>Following distance</u>	<u>Technology</u>
1970	12 years	Punch tape peripherals (domestic external development)
1975	5 years	FEX storage unit (French license)
1980	4 years	8 inch floppy disk drive unit (our own development)
1982	1.5-3 years	5 1/4 inch floppy disk drive unit (floppy) (our own development)

(Since 1975 we have been the first to appear with our products in the socialist countries.)

Development of Modernization in the 1980's

The determining factors for development are: accommodation to the ESZR [Uniform Computer Technology System] and MSZR [minicomputer system] developmental concepts; the technical base and manufacturing traditions of the MOM; and the special needs of personal computers.

Our developments will be restructured in the 1980's. After nearly 10 years we have stopped manufacture of punch tape devices. In the area of fixed head stores, we have replaced the DM 0.8 product, originally manufactured on the basis of a French license, with manufacture of the DM 2.5 stores, the result of our own development and having nearly three times the capacity. We have significantly reduced the import fraction and have increased our manufacturing capacity nearly two times. At the beginning of the 1980's we started manufacture of the floppy disk drive units (during 3 years we extended the assortment of these to every version--8 inch normal, 5 1/4 inch mini, single and double density, one and two sides, normal size and half size).

The concentration and modernization of production and organization of large series manufacture began last year. In the second half of 1982, in the course of structural development, we started development of Winchester type stores. We regard this type of store as our most significant development for the period of the Seventh 5-Year Plan--in addition to modernized versions of our existing products.

A further development of the special technologies (head manufacture and information carrier) is indispensable for production of the products. In order to be independent of the shippers and primarily in order to moderate our foreign exchange costs we must develop our own production of head units for disk stores too. The work will be completed this year.

Parallel with the development of Winchester type stores we must develop the technology for manufacture of the head unit also. Further development of the information carrying magnetic layer must continue in two directions. On the one hand with development of a technology for a protective layer WCo active carrier for the Winchester stores and with development of a technology for protective layer NiCo active carriers for the Diszkmom type stores. The latter development has been going on since 1982 at the MEV [Microelectronics Enterprise] on commission for the MOM.

Further development of the larger capacity Diszkmom type stores will require development or adoption of integrated head technology. (Without this it will not be possible to attain storage capacity above 10 M bytes.) At present no domestic developer has undertaken this and there is no foreign exchange to purchase a license.

The most important parameters of the types of stores which can be manufactured at the MOM are shown in the following table.

Store Type	Capacity (M bytes)	Average access time (ms)	Specific price (dollars per M byte)
Fixed head disk stores	1-100*	8-10	25*-1,000
8 inch disk stores	0.4-1.6	80-90	5-15
5 1/4 inch disk stores	0.2-1	200	4-20
8 inch Winchester disk	10-100	40-100	15-50
5 1/4 inch Winchester disk	5-30	40-100	20-60

Values marked with an asterisk belong to the integrated head version.

The computer technology products now manufactured by the MOM, under development or to be manufactured in the Seventh 5-Year Plan period as a result of developments planned for the next few years are the following:

Fixed Head Disks (Diszkmom Family)

Type:	DM 0.8	DM 2.5	DM 5	DM 10	DM 80
Origin	license	own	license	own	--
Status	being discontinued	in series manufacture		Under development	To be developed
Capacity	0.8 M byte	2.5 M byte	5 M byte	10 M byte	80 M byte
Import content	3 dollars per 1,000 forints	1.5 dollars per 1,000 forints	2 dollars per 1,000 forints	planned to be under 1 dollar per 1,000 forints	

MOM Disk Drives (8 inch)

Type:	MF 3200	MF 6400	MF 6400D	MF 6400FD
Status	in series manufacture		development complete	To be developed
Modernness	going out	the type of future		
Capacity	0.4 M bytes	0.8 M bytes	1.6 M bytes	1.6 M bytes
Form	normal size		half size	
Specific price	10,000 forints/ M bits	6,000 forints/ M bits	4,000 forints/ M bits	4,000 forints/ M bits
Import content	2 dollars/ 1,000 ft.*	2 dollars/ 1,000 ft.*	2 dollars/ 1,000 ft.	--

* Reduced to 1 dollar per 1,000 forints in second half of 1984.

Type:	MF 1800/900	MF 4001	MF 4002
Status	in series manufacture		under development
Capacity	0.225 M bytes	0.5 M bytes	1 M byte
Form	normal size	half size	half size
Specific price	10,000 ft./ M bits	5,000 ft./ M bits	3,000 ft./ M bits

Import content	3 dollars/ 1,000 ft./ M bits [sic]	2.5 dollars/ 1,000 ft.*	--
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* Can be reduced to an average under 1.5 dollars per 1,000 forints in 1985.

Developmental Goals of the MOM

Type:	MW 12	MW 24	MW 100
Status	under development		to be developed
Category	5 1/4 inch	5 1/4 inch or 8 inch	8 inch
Capacity	10-12 M bytes	10-30 M bytes	80-120 M bytes
Specific price	8,000 forints/ M bits	4,000-6,000 forints/M bits	3,000 forints/ M bits
Planned start of series manufacture	1985	1986	--

In the wake of the production capacity expansion carried out last year the quantity which can be manufactured annually (calculated for the lead model) is 800-1,000 units.

It is expected that trade will shift toward the larger capacity models. The conditions are not yet given for development of the DM 80 model. According to information available today, however, the manufacture of large capacity stores will be a condition for our remaining on the market in this product group by the end of the 1980's. For this reason, despite the present unfavorable conditions, we cannot give up our developmental goals.

Floppy Disk Drive Units

As a result of the activity of past years we are today in first place among the manufacturers of the socialist countries in regard to product variety and size of production. It appears that the GDR, that is Robotron, will endanger this hegemony. They have set up for self-supply in mini disk needs. At present they cannot cover their OEM export goals, but we cannot leave this out of the calculation.

Bulgarian export is very exclusive, limited basically to the Soviet Union. Czechoslovakia has only domestic supply as a goal, but as of now is forced to import. The Poles have started manufacture on the basis of a license, but because of the import needs of the product they have been forced to cut back on the market. The start of Soviet production can be expected in the near future. It can be taken as certain that they will take care of their domestic supply, but their manufacturing capacity will not catch up with their swiftly increasing needs for years yet. They will probably be limited in variety and according to our experiences their speed of model exchange will be moderate.

The MOM carried out a significant expansion in 1984 to manufacture these disk drives. So it may be that in the Seventh 5-Year Plan period we will produce 30,000-40,000 units per year.

The Winchester type store is a new type which appeared at the beginning of the 1980's. This device for information storage is expected to surpass the combined extent of every type of direct access store known thus far.

The industry of the leading capitalist countries prepared to produce them within a year and a half. It is characteristic that although the number of producers is about 50, the number of basic designs can be put at only a few. Technology transfer accompanies the spread of them. Compared to the large number of final product manufacturers the number of producers of subassemblies (information carrying disks, head units, motors, etc.) is very small.

At present this type is not manufactured in the socialist countries. But virtually every socialist country (the GDR, Soviet Union, Bulgaria and Czechoslovakia) is doing development. There are no signs of production cooperation or specialized subassembly production; the background industry for this, and especially the special technologies, are undeveloped and the cooperation is unorganized.

For this reason every country engaged in development is struggling with development started throughout the entire vertical structure. Our development started at the MOM in the second half of 1982. The technological license of the enterprise purchased earlier (head manufacture and magnetic layer application) constitute the roots for realizing development and manufacture.

A significant further development is needed to introduce the Winchester technology. Especially great resources must be concentrated on development of a wear resistant (protective layer or contact layer) signal carrying magnetic layer. In the beginning the precision stepping motors must be imported; later they will be replaced by domestic developments. The electronics can be provided in part by manufacturers in the socialist countries, in part we expect the MEV to develop and supply (equipment oriented) IC's.

The planned series size--calculated for the lead model--will be 10,000-12,000 units per year at the time manufacturing gets started. The present manufacturing conditions are not sufficient, either in size or specific composition, to ensure production. Supplementary investments in 1985-1986 are needed to realize this.

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HUNGARY

FUTURE OF FIBER OPTICS IN HUNGARY

Budapest SZAMITASTECHNIKA in Hungarian No 10, Oct 84 p 15

[Article by A. K.: "Present and Future of Light Conducting Fibers"]

[Excerpt] In our country a program was prepared under the guidance of the National Technical Development Committee for the development of light conducting fiber telecommunications and realization of a complete system for this. The Telephone Factory, the Telecommunications Research Institute, the Technical Physics Research Institute of the Hungarian Academy of Sciences and the Postal Experimental Institute (PKI) are taking part in the developmental work. In the national program for fiber optics development the Telephone Factory will solve tasks connected with digitization of signals and will be prime contractor for complete systems. The Telecommunications Research Institute will develop a device making possible transmission of 480 telephone channels and the Technical Physics Research Institute will develop light sources. It is the task of the PKI, among other things, to design the network and build and operate an experimental network.

The participants hope that in the first or second year of the next 5-year plan operational light-conducting fiber telephoning will become possible in our country and that a complete system of fiber optics telecommunications will be realized gradually later. According to the plans the optical fibers will be obtained from socialist bloc import. Our country started developmental work on light conducting fiber telecommunications 5 years later than the GDR and the Soviet Union. Although the initial steps are reassuring we are not at all free to think that the backwardness of our telephone network can be cleared up with this technique at one blow. The telephone question is basically a question of investment and investment policy. An integrated light-conducting fiber system could offer real advantages for the domestic populace if the telephone exchanges and the network are modernized to the appropriate degree.

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HUNGARY

DIRECTOR OF COMPORGAN INTERVIEWED

Budapest SZAMITASTECHNIKA in Hungarian No 10, Oct 84 p 16

[Interview with Karoly Pogany, director of the Comporgan Systems House, by Margit Takacs: "From Idea to Product"]

[Text] In 1971 eleven industrial enterprises and two research institutes formed the Computer Technology and Organizational Center of the Hungarian Signal Technology Association. Since October of last year we have known the institution even here at home as the Comporgan Systems House, instead of the earlier long name. The enterprise employs about 300 workers and recently has called attention to itself with new initiatives--such as the Software '84 exhibit in November of last year, the forming of a subsidiary enterprise and issuing bonds.

"Where is Congress going?" we asked director Karoly Pogany, who is an economist by his original profession and who has led the enterprise since it was founded.

[Answer] Already in the mid-1970's our enterprise deliberately prepared to produce software as a commodity. At that time, looking forward two decades, we saw that there would be a large market for software, as a commodity, in Hungary, that software products which could be used many times would be a great advantage for users as compared to ad hoc development. We came to this conclusion in part from experiences with our domestic ad hoc software work between 1970 and 1975 and partly from experiences with export work done for capitalist customers.

In the first place we wanted to create a form advantageous for the customers. We sell a software product for 4 percent of the developmental cost; naturally the cost of putting it into operation is added to this. This means for us that the developmental costs of a product are returned after 25 sales. Perhaps even more important than the fact that the customer can get the software he chooses at a very favorable price is the fact that before buying he can see and try out the system, then it can be put into operation immediately, he can use it and not have to "wait out" the developmental time. This method of price formation also makes the developing institution interested in preparing software which can be used in many places.

An OKKFT [National Medium Range Research and Development Plan] competition was issued in June 1980 in response to which we prepared--without state support and before the time limit--our computerized industrial enterprise leadership and data processing system, elements of which we have already sold more than 100 times.

An Organizational Subsidiary Enterprise

[Question] In February Comporgan, Metrimpex and the West German Diebold firm created a joint subsidiary under the name CM Diebold Hungarian Ltd. Why did they need this and how is the work of CM Diebold linked to that of Comporgan?

[Answer] Earlier we developed only batched mode systems; that is, at a given enterprise, even after introduction of computer processing, the workers submitted and received data in the customary manner, in writing. Now we are developing conversational mode systems, which means that the computer, or rather a picture screen terminal, goes right beside the work bench or desk. In many cases paper completely disappears from the work process; for example, in a warehouse guidance and record-keeping system every change, every transaction must be shown on the terminal. This fact demands plant organization too when the computer system is introduced. So it is not enough for us to develop the software and sell it as a commodity; rather, in the interest of successful, efficient use of it, we must provide the organizational expertise too.

Since we work for enterprises in many branches of industry we would have to know the peculiarities of all of them, from the chemical industry to the wood industry. We would need many organizational specialists and we might be able to use their expertise or knowledge only one time, at one machine industry enterprise for example. We have had contact with the West German Diebold consulting firm for about three and a half years; with formation of CM Diebold Hungarian Ltd. we can have access, for forints, to the western organizational experience and methods which can be used in various branches of industry.

Formation of this subsidiary enterprise is part of the work we are doing in the interest of problem solving organization so that we can provide the ordering enterprise the organizational work, the software and the computer and can fulfill their other special requests as well.

Bonds

[Question] Comporgan recently issued bonds, at 14-16 percent interest, higher than all the others. The time limit for subscription was the end of March. What success did this initiative have?

[Answer] At the end of 1983 the developmental funds of the enterprises had shrunk significantly so in many places there was no money to buy a computer. Comporgan has a software inventory worth about 120 million forints. In order to aid sale of the software products we would like to lease computers, and we are buying the computers to be leased from the money collected with the bond subscription. We planned a subscription of 100 million forints when the decree still made possible the purchase of bonds at the burden of the reserve

fund too. After modification of the decree this was no longer possible, so-- by the prolonged time limit, 30 June--we had collected about 60 million forints.

Looking Toward the Year 2000

[Question] What are your future plans?

[Answer] What can a computer user expect from a firm like the Comporgan Systems House at the end of the century? By the year 2000, even in our country, the computer technology and organizational culture will probably reach a developmental level where we will have, for example, the automated office. And naturally this will require the appropriate software products.

As for production work, we must look at the production process from the idea of the product to its manufacture and delivery. In a factory everything depends on good design. When they make the product in the shop they are only carrying out the instructions already given; in a fundamental way the final product depends on the level of engineering design and technology and on the balance of the process. In the case of computer support for the production process we must look at engineering design and production control together.

Our goal is that by the 1990's Comporgan will be cultivating with good efficiency both office automation and the area of flexible manufacture, interpreted broadly in the way mentioned. We will be able to aid the birth of an idea for a product if we collect the information and put it on the desk of the developers with computerized support, and with an automated guidance information system the leaders will be able to follow the intermediate steps of development and so will be able to intervene in accordance with a flexibly changing business policy.

We are already "on track" in engineer designing. There are about 200,000 types of industrial products, and some sort of engineering expertise is needed for each of them. Let us say there are 60 things an engineer should know which are needed in various ratios for the development of some product; aspirin will require more chemical information while an automobile part will require more mechanical information. Engineering expertise is an amalgam of the basic sciences. The computer database would contain these basics and the algorithmizable steps; the developmental engineer would add his special expertise to this. It turns out that Soviet academicians have already begun to put the laws of the basic sciences on a computer; a few Soviet scientists visited Hungary this year and we are working on this task with them.

[Question] It is barely more than 5 years to 1990. What guarantee do you have that this conception, these ideas, will be realized successfully by then?

[Answer] We will have the personnel, professional and technical conditions by 1985 and around 1988 we will be producing the software products too. Anyone who works for us must be able to look ahead 7-8 years and must accept this conception, for only then can we expect truly good work from him. So when selecting our colleagues the way of looking at things is just as important

as professional knowledge, but he must be able to compete on the world market with the latter because 25-30 percent of the sales receipts of our enterprise comes from capitalist export.

It turns out from a number of conversations that many people think from one month to the next and do not see ahead more than half a year. I feel that it is very important that the workers of our enterprise--their average age is 32-33 years--should know what they want to achieve in their profession, and plan their careers.

Suitable interest and a secure livelihood should be ensured in addition to professional prospects. We would like to introduce an experimental wage regulation system the essence of which is that if they increase the centralized social net income by 10 percent then the wage which can be paid increases by 10 percent too. Naturally, they will assume the risk side of this too; if this decreases by, let us say, 15 percent then we will be distributing less wages by the same amount too.

We should consider social support important too; we fulfill every leave and housing loan request. We give every beginner a housing loan of at least 300,000 forints to be paid off in 25 years, and after 5 years, if we are satisfied with his work, we cancel half of the remainder. The financial funds for this are produced by significant growth in sales receipts--the growth was 17 percent from 1982 to 1983 and we planned on 30 percent from 1983 to 1984.

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HUNGARY

BOOK ON DATA PROCESSING CONCEPTS

Budapest SZAMITASTECHNIKA in Hungarian No 10, Oct 84 p 19

[Review by Arpad Horvath: "MSZ 7788/8: Data Processing Concepts; Data Integrity and Data Protection"]

[Text] One consequence of the swift development and broad spread of computer technology is that there is perhaps no other special area where language useage diverges so much today as here. The same concept can appear with a different name in professional books, journals, professional lectures, various factories and even in certain areas of the English or German languages. This linguistic and conceptual confusion made necessary a standardization of domestic computer technology terminology, as a result of which the MSZ [Hungarian Standards] 7788 standards series is an attempt at consolidation.

The goal of the series is to order computer technology language usage in a comprehensive way so that it should be in harmony with international practice. Taking this into consideration the standards of the series were prepared as an adaptation of the international standard series "ISO 2382 Data Processing Vocabulary."

The eighth standard in the series contains the names of 79 concepts connected with the data integrity and data protection of data processing systems and gives terse definitions. The chief chapters are the following: 1. General Concepts, 2. Data Checking, 3. Error Detection, 4. Error Treatment, 5. Review and Supervision, and 6. Data Integrity and Protection of Rights Attaching to the Person. It should be noted that one can find in the several chapters a total of 26 concept definitions for various checks. The first among the general concepts in the first chapter is data protection. Data protection is: "Protection against the inadvertent, or perfidious changing, destruction or publication of the hardware, software or data in data processing systems."

In the course of preparing the standard the special committee has caused a problem by the concept of the performance ability test appearing in this chapter, that is, finding a Hungarian equivalent for the English "benchmark test," since the definition according to the ISO is not precise. Thus the Hungarian definition differs a little from that of the ISO.

In this chapter one can find six concept definitions for various types of addresses. One should note that the Hungarian standard permits use of

well-known English abbreviations for the name of the addresses (for example, VOL, HDR, etc.).

The second chapter contains, among other things, definitions of the concepts of order, format, completeness, authenticity, value limit, value range, overflow, consistency and permuted checking.

The concepts of interest in the third chapter are "key insertion" and "modulo checking"; in the fourth chapter "restart," "direct restart" and "fatal error"; and in the fifth chapter "review," "review file" and "error trace."

The greatest debate in the special committee took place when discussing the sixth chapter. It was decided with a minimal voting majority that the Hungarian "adatepseg" would be used for the English "data integrity." In the definitions in this chapter for "rights attaching to the person" and "protection of rights attaching to the person" it had to be remembered that the standard should be in harmony with the paragraph 21 of Ministry of Interior decree I/1981 (I. 27.) dealing with this theme.

The standard has appeared and it will go into effect on 1 January 1985. Those setting the standard trust that it will be widely used in computer technology, in a way similar to that of other standards in the series.

8984

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INDUSTRIAL, AGRICULTURAL AREAS OF ECOLOGICAL DANGER DESCRIBED

Warsaw WIADOMOSCI STATYSTYCZNE in Polish No 8, Aug 84 pp 24-29

[Article by Dr Jan Wojtan, GUS (Main Office of Statistics) Department of Information and Analyses: "Areas of Ecological Danger in Poland--Industry and Agriculture"]

[Text] The statement that industrial activity is the primary source of danger and devastation to the natural environment appears to be a truism today. Nonetheless, one cannot ignore this scheme in characterizing the areas of ecological danger in Poland. It should be remembered that one-third of the socialized industrial plants, employing over 50 percent of all the people employed in the socialized industrial plants, are located on only 11.3 percent of the country's area, Poland's area of ecological danger. To make a comparison, 35.5 percent of the country's total population lives in these areas of ecological danger.

These data tell us that the industrial plants located in areas of ecological danger are large plants having a greater concentration of employees than the other areas in Poland. For example, 1,036 people are employed on average per each fuel-energy industrial plant in the areas of ecological danger, compared to 80 in the remaining areas and 477 for the country as a whole.

The reason for these differences is that the country's largest industrial combines are located in the areas under investigation. Only food industry employment shows a significant correlation with population, whereas the wood-paper industry is concentrated outside the areas of ecological danger (over 73 percent of the nation's employees).

Areas of ecological danger are characterized by high employment (on a national scale) in the fuel-energy, metallurgical and chemical industries, that is, in those subsectors of industry that are most onerous for the environment. The especially large employment level in the fuel-energy industry relative to the overall employment in the socialized economy is noticeable in Rybnik, Belchatow, Upper Silesia, Konin, Walbrzych, Turoszow and Plock. It should be said that every other person employed in Poland's fuel-energy industry works in the Upper Silesia area, and every fifth person works in Rybnik. The seven areas of ecological danger mentioned above contain on their territory 18 percent of all the socialized fuel-energy plants and 80 percent of the total employed in the nation.

The metallurgy industry is concentrated mainly in three areas, that is, in Upper Silesia, Krakow and Legnica-Glogow. These areas contain over 50 percent of the socialized metallurgical industry plants and employ over two-thirds of those employed in this industry nationally. The chemical industry is also highly concentrated in the analyzed areas, but is very evenly distributed throughout these areas. About 60 percent of all those employed by the country's chemical industry are concentrated in these areas, the largest being Upper Silesia (10 percent), Bydgoszcz-Torun and Tarnow (6 percent each).

But it is an obvious fact that the rapid degradation of the natural environment can be seen in the areas of ecological danger. After all, four-fifths of all those employed nationally in the fuel-energy, metallurgical and chemical industries, industries that are especially harmful to the environment, are concentrated in these areas. At the same time, in recent years new facilities that also degrade the environment continue to be built in these areas. For example, the construction in Upper Silesia of the large Katowice Metallurgical Combine and the construction of the Polaniec thermoelectric plant in the Tarnobrzeg area.

Considering their areas and populations, greater concentrations can also be seen in the areas of ecological danger in such subsector groups as the electrical machinery, light and mineral industries. The electrical machinery industry is concentrated mainly in the Upper Silesia, Gdansk, Wroclaw, Lodz and Poznan areas. Light industry is concentrated mainly in the Lodz, Upper Silesia, Czestochowa and Bydgoszcz-Torun areas. And the mineral industry is concentrated mainly in the Upper Silesia, Krakow, Opole and Biala Zaglebia areas.

It should also be remembered that specific areas are "specialized" in certain types of industrial production, concentrating the majority of people employed by the socialized industry in these areas, for example:

- Rybnik, the fuel-energy industry;
- Gdansk, the electrical machinery industry;
- Pulawy, the chemical industry;
- Lodz, light industry.

The concentration of a large number of workplaces and thus employees in one or at most three subsectors of industry is a characteristic of the industrial landscape. Upper Silesia is linked with the mining-metallurgy industry; the Lodz area, with the textile industry; Gdansk, shipbuilding; Pulawy, nitrogen; and Tarnobrzeg, sulfur. Of course, this specialization and concentration is beneficial from the economic viewpoint, but it is not very beneficial from the viewpoint of protecting the environment because "giant" plants place a great burden on the environment. In 1982 more than 40 percent of all the untreated industrial sewage in Poland was produced by two large plants:

- the Lenin Metallurgical Combine in Krakow (27.6 percent of the total industrial wastes requiring treatment);
- the Boleslaw Mining-Metallurgical Plants in Bukowno, Katowice Province (16 percent).

Table 1. Average Number of Employees Per Industrial Plant in 1982

Specification	Total	Socialized industry							All other subsectors of industry
		Fuel-energy	Metal-lurgical	Elec-trical-Mach.	Chem-ical	Min-eral	Wood-paper	Light	Food
Poland	115,7	477,1	2204,3	161,3	227,8	109,3	73,0	76,7	48,6
Areas of ecological danger, total	176,7	1036,2	2368,6	184,3	317,4	130,1	70,4	89,6	70,6
Belchatow	392,6	3279,0	—	—	287,5	35,0	—	1,0	9,4
Biala Zaglebia	142,8	99,5	—	266,2	42,1	226,8	147,1	32,7	117,6
Bydgoszcz-Torun	160,8	233,8	448,0	214,2	584,9	70,4	102,9	91,8	90,9
Cheim	107,9	65,0	—	43,5	28,0	384,0	70,6	174,9	54,0
Czestochowa	140,9	249,3	2202,4	79,9	127,6	123,4	80,2	175,0	64,2
Gdansk	138,6	203,5	199,0	295,6	130,7	38,1	77,8	50,1	98,5
Upper Silesia	294,6	2123,8	2232,4	250,3	291,9	148,2	50,6	50,0	43,1
Inowroclaw	138,3	64,2	—	83,6	340,4	496,3	56,2	116,4	71,2
Jelenia Gora	89,6	74,0	—	70,5	587,7	174,7	70,3	93,6	25,1
Konin	180,0	850,7	2330,0	125,0	29,0	66,0	23,8	122,9	51,1
Krakow	120,9	240,9	5375,0	125,5	160,1	128,4	43,4	35,4	85,8
Legnica-Glogow	123,7	68,6	3122,4	106,8	205,4	100,5	73,3	65,0	39,8
Lodz	154,5	155,8	54,0	117,4	293,0	45,5	56,2	220,8	92,2
Myszkow-Zawiercie	296,7	73,0	6065,0	319,2	66,5	282,9	362,2	372,6	29,8
Opole	157,4	441,8	270,0	187,7	582,2	246,7	80,6	104,6	49,9
Plock	225,2	2203,8	—	358,3	75,5	51,0	89,8	104,4	98,7
Poznan	116,8	280,7	218,5	158,1	186,2	87,2	100,9	31,6	106,2
Pulawy	91,1	319,0	—	27,0	558,3	86,5	26,5	33,9	25,1
Rubnik	327,9	3190,5	—	125,8	278,0	38,5	14,9	16,9	34,8
Szczecin	127,7	220,2	649,5	155,4	258,6	26,5	91,8	52,6	141,2
Tarnobrzeg	222,9	337,6	7779,0	525,7	497,4	39,4	27,5	53,2	46,7
Tarnow	179,6	153,8	—	237,4	1233,5	108,1	88,0	38,0	107,5
Tomaszow	122,1	66,8	—	13,6	1007,3	79,3	35,5	143,0	49,0
Turoszow	133,0	1548,6	—	149,2	113,5	166,5	38,4	63,4	23,3
Walbrzych	231,8	1189,1	—	242,1	132,0	327,7	106,4	151,1	49,0
Wloclawek	179,4	100,3	—	216,0	714,4	314,6	219,7	71,8	142,9
Wroclaw	130,5	192,0	631,4	193,6	298,5	72,2	61,0	41,4	107,8
All other areas	84,7	80,2	1687,5	146,2	159,0	98,4	73,9	69,0	41,6
									111,7
									143,5
									1505,0
									138,1
									190,3
									70,2
									148,5
									121,1
									161,4
									148,0
									101,4
									523,7
									130,2
									246,1
									77,9
									183,0
									90,0
									135,0
									136,1
									183,3
									67,8
									219,6
									297,6
									50,7
									95,0
									361,2
									88,2
									38,2
									169,6
									94,3

Table 2. Employment Structure in Socialized Industry in Areas of Ecological Danger in 1982

Specification	Total	Socialized industry							All other subsectors of industry	
		Fuel- energy	Metal- urgical	Elec- trical Mach.	Chem- ical	Min- eral	Wood- paper	Light		Food
		in percentage								
Poland	100,0	13,2	5,2	32,5	6,4	5,6	5,4	15,6	11,4	4,7
Areas of ecological danger, total	100,0	23,1	8,2	28,6	7,6	4,4	2,8	13,3	7,8	4,2
Belchatow	100,0	59,6	—	—	10,5	1,3	—	0,0	1,2	27,4
Biala Zagłębia	100,0	1,0	—	45,2	1,5	21,3	6,0	6,6	12,8	5,6
Bydgoszcz-Torun	100,0	3,1	0,4	41,6	17,3	2,0	5,0	15,1	10,6	4,9
Chełm	100,0	1,1	—	6,6	0,7	32,3	4,8	32,4	19,1	3,0
Częstochowa	100,0	3,8	18,6	21,1	2,2	6,7	3,2	27,7	4,4	12,3
Gdańsk	100,0	4,8	0,1	55,6	3,1	1,5	5,0	8,9	16,6	4,4
Upper Silesia	100,0	45,6	15,0	21,1	4,3	3,5	1,0	3,9	3,3	2,3
Inowrocław	100,0	3,1	—	12,9	26,2	23,9	2,2	9,5	17,2	5,0
Jelenia Góra	100,0	3,6	—	23,2	16,8	11,4	10,3	24,4	4,5	5,8
Konin	100,0	44,9	8,2	13,6	0,2	0,2	1,2	16,9	9,3	5,5
Kraków	100,0	5,4	21,7	26,7	9,5	8,3	2,1	8,3	10,9	7,1
Legnica-Ślōgów	100,0	2,0	35,0	20,6	2,6	5,7	3,1	14,4	8,3	8,3
Łódź	100,0	2,7	0,0	23,0	6,7	0,9	2,2	56,0	5,1	3,4
Myszków-Zawiercie	100,0	1,2	19,5	39,9	0,4	8,2	5,8	21,5	2,3	3,0
Opole	100,0	11,9	0,4	27,9	16,6	15,2	5,1	12,2	7,7	3,0
Płock	100,0	38,4	—	26,5	1,3	0,5	3,5	12,7	14,2	2,9
Poznań	100,0	3,2	0,5	53,8	8,7	1,7	6,3	6,4	13,5	5,9
Pulawy	100,0	9,5	—	6,2	50,1	5,2	2,9	7,8	7,3	11,0
Rubnik	100,0	83,6	—	9,4	1,0	0,8	0,4	0,8	3,4	0,6
Szczecin	100,0	5,6	1,5	38,7	9,0	1,1	5,0	9,7	22,3	7,1
Tarnobrzeg	100,0	6,7	11,0	50,4	12,6	1,0	1,2	5,5	5,3	6,3
Tarnów	100,0	4,6	—	29,6	37,1	6,3	3,2	4,8	12,7	1,7
Tomaszów	100,0	2,0	—	2,0	35,6	2,8	2,9	44,1	7,2	3,4
Turoszów	100,0	39,3	—	15,9	1,2	11,0	2,1	19,3	3,8	7,4
Wałbrzych	100,0	42,4	—	16,3	1,5	9,2	2,2	21,3	5,1	2,0
Włocławek	100,0	2,8	—	25,3	20,2	10,2	13,3	8,4	17,9	1,9
Wrocław	100,0	3,5	3,0	52,9	10,1	2,4	3,3	9,5	8,9	6,4
All other areas	100,0	2,7	1,9	36,7	5,2	6,8	8,2	18,0	15,2	5,3

The Lenin Metallurgical Combine in Krakow also occupies first place nationally with regard to polluting the air. The Katowice Metallurgical Combine in Dabrowa Gornicza (Katowice Province) and the Turow Thermal-Electric Plant in Bogatyn (Jelenia Gora Province) occupy second and third places, respectively. At the end of 1982, about one-fourth of all the industrial waste material in the country was produced by five industrial plants, namely:

- The Rudna Mining Enterprises in Polkowice, Legnica Province (8.8 percent of the nation's total);
- the Lubin Mining Enterprises in Lubin, Legnica Province (5.3 percent);
- the Sosnica Bituminous Coal Mine in Gliwice, Katowice Province (4.4 percent);
- the Lenin Metallurgical Combine in Krakow (4.1 percent);
- the Bialy Orzel Mining-Metallurgical Plants in Piekare Slaskie, Katowice Province (3.8 percent).

The areas of ecological danger are already sufficiently "seeded" with industrial plants, and every increase in their industrial activity causes an inordinately large increase in the threat to the environment. The existing threat in some areas has now reached such a level that the threat of an ecological catastrophe exists (for example, the Lenin Mill in Krakow).¹ It is necessary to take immediate action to improve the situation in these areas by, among other things:

- opposing increased industrial activity by those plants that are especially harmful to the environment;
- decreasing pollution of the environment by industrial plants by installing equipment to diminish the extent of the danger to the environment and also by modernizing the production process (technology).

Agriculture

The expansion of agriculture in the areas of ecological danger will run into increasing limitations because of the increasing and numerous threats to the environment if man's economic activity is not reorientated to take into consideration the cost-effectiveness of changing the natural environment.

In recent years the dangers have increased manyfold because of the emissions into the atmosphere of dusts and gases by industrial plants. A high concentration of rare metals in the atmosphere and soil can kill plants completely or decrease yields, which very often is accompanied by decreased nutritive values caused by the decreased assimilation of basic food ingredients. In areas near nonferrous metals mills, the concentration of harmful chemical elements has reached such levels that plants can no longer grow there, and the biological life of the soil has been destroyed.

The chemical transformation of the soil--the accumulation of toxic chemical elements in soil--is of an irreversible nature and will affect plant and animal life even after the emissions have ceased. Thus, the irreversibility of this process has after-effects that can be harmful even in the future.

1. See "Protecting the Environment and Water Management," 1983, GUS Department of Agriculture and Food Management.

Table 3. Share of Employment in the Socialized Industry in Areas of Ecological Danger With Respect to the Country as a Whole in 1982

Specification	Total	Socialized industry							All other subsectors of industry
		Fuel-energy	Metal-lyrical	Elec-trical	Chem-ical	Min-eral	Wood-paper	Light Food	
		100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0
Poland	100,0	90,2	81,9	45,3	60,5	40,8	26,6	35,1	45,6
Areas of ecological danger, total	51,5	0,5	—	—	0,2	0,0	—	0,0	0,7
Belchatow	0,1	0,1	—	1,2	0,2	3,4	1,0	0,4	1,0
Biala Zaglębia	0,9	0,1	0,2	3,0	6,3	0,8	2,2	2,3	2,4
Bydgoszcz-Torun	2,4	0,5	—	0,1	0,0	1,6	0,2	0,5	0,2
Chem	0,3	0,0	—	0,9	0,5	0,8	0,8	0,5	3,4
Czestochowa	1,3	0,4	4,8	0,1	1,5	0,8	2,8	1,8	2,9
Gdansk	3,1	1,1	0,1	5,3	10,0	9,5	2,8	4,4	7,4
Upper Silesia	15,0	51,8	43,4	9,7	1,9	2,0	0,2	0,3	0,5
Inowroclaw	0,5	0,1	—	0,2	1,4	1,1	1,1	0,9	0,7
Jelenia Gora	0,6	0,1	—	0,4	0,0	0,0	0,1	0,7	0,7
Konin	0,6	2,2	1,0	0,3	0,0	0,0	0,1	0,5	0,7
Krakow	2,9	1,2	12,0	2,4	4,2	4,3	1,1	1,5	2,8
Legnica-Glogow	1,8	0,3	12,1	1,3	0,7	1,9	1,0	1,7	3,1
Lodz	4,7	1,0	0,0	3,3	4,9	0,7	1,9	17,0	3,4
Myszkow-Zawiercie	0,7	0,1	2,6	0,9	0,0	1,0	0,8	0,1	0,2
Opole	1,4	1,3	0,1	1,2	3,6	3,9	1,3	1,1	0,9
Plock	0,5	1,5	—	0,4	0,1	0,0	0,3	0,4	0,3
Poznan	2,0	0,5	—	3,2	2,7	0,6	2,3	2,3	2,4
Pulawy	0,2	0,2	0,2	0,0	1,8	0,2	0,1	0,1	0,5
Rubnik	3,1	19,4	—	0,9	0,5	0,4	0,2	0,2	0,4
Szczecin	1,9	0,8	0,6	2,3	2,7	0,4	1,8	1,2	2,9
Tarnobrzeg	1,6	0,8	3,4	2,4	3,1	0,3	0,3	0,6	2,1
Tarnow	1,0	0,4	—	0,9	6,0	1,2	0,6	1,2	0,4
Tomaszow	0,4	0,1	—	0,0	2,5	0,2	0,2	0,3	0,3
Turaszow	0,4	1,3	—	0,2	0,1	0,9	0,2	0,5	0,7
Walbrzych	1,2	3,8	—	0,6	0,3	2,0	0,5	0,1	0,5
Wloclawek	0,6	0,1	—	0,4	1,7	1,0	1,4	0,3	0,2
Wroclaw	2,3	0,6	1,4	3,8	3,6	1,0	1,4	1,4	3,1
All other areas	48,5	9,8	18,1	54,7	39,5	59,2	73,4	56,1	54,4

Table 4. Structure of Land Utilization in 1982 (status in June)

Specification	Farmland				Meadow-		Pasture-		All other land	
	Arable		Orchards		land		land		Forests-fallow land	
	Total	land	land	land	land	land	land	land	land	land
In percentage of total area										
Poland	60.4	46.5	0.9	8.1	4.9	27.8	11.8			
Areas of ecological danger,										
total	53.6	40.5	0.9	8.2	4.0	25.6	20.8			
Belchatow	48.8	38.6	0.1	8.0	2.1	25.8	25.4			
Biala Zaglebia	56.6	43.8	0.6	7.4	4.8	29.8	13.6			
Bydgoszcz-Torun	39.7	29.8	0.9	6.1	2.9	39.9	20.4			
Cheim	73.2	51.6	0.9	16.5	4.2	15.2	11.6			
Czestochowa	54.6	41.7	1.3	8.0	3.6	18.5	26.9			
Gdansk	48.7	34.3	0.4	8.8	5.2	23.4	27.9			
Upper Silesia	41.2	30.2	1.1	7.0	2.9	28.5	30.3			
Inowroclaw	79.3	70.6	1.0	4.7	3.0	3.6	17.1			
Jelenia Gora	32.3	12.7	0.2	11.2	8.2	53.0	14.7			
Konin	65.7	52.8	0.4	8.8	3.7	16.2	18.1			
Krakow	71.3	56.9	2.6	9.1	2.7	13.7	15.0			
Legnica-Glogow	59.5	46.7	0.4	7.3	5.1	26.4	14.1			
Lodz	56.9	44.9	1.8	7.6	2.6	16.4	26.7			
Myszkow-Zawiercie	52.1	38.4	1.5	8.4	3.8	30.0	17.9			
Opole	48.2	38.0	0.8	7.6	1.8	32.9	18.9			
Plock	64.2	57.1	2.0	2.6	2.5	9.1	26.7			
Poznan	50.6	43.5	1.5	4.4	1.2	22.0	27.4			
Pulawy	60.7	50.9	1.3	5.5	3.0	27.2	12.1			
Rybnik	57.9	44.9	1.1	8.8	3.1	19.3	22.8			
Szczecin	37.9	25.0	0.5	9.7	2.7	28.6	33.5			
Tarnobrzeg	54.2	39.2	0.8	9.4	4.8	33.0	12.8			
Tarnow	67.9	53.0	1.0	7.6	6.3	21.0	11.1			
Tomaszow	39.1	32.0	0.7	4.5	1.9	47.7	13.2			
Turoszow	62.6	42.7	1.1	11.7	7.1	18.2	19.2			
Walbrzych	48.5	24.0	0.3	9.7	14.5	36.7	14.8			
Wloclawek	46.7	38.8	1.3	3.5	3.1	33.4	19.9			
Wroclaw	56.8	45.2	0.7	7.1	3.8	17.8	25.4			
Areas not ecologically										
endangered	61.3	47.3	0.9	8.0	5.1	28.1	10.6			

Polluting the atmosphere and soil with some chemical elements and compounds engenders a number of negative consequences in the environment that are manifested by, among other things, a concentration of products in plants that are not unimportant for health. The use by farmers of fodder from land polluted by industrial fallout significantly decreases animal weight compared with animals fed fodder from noncontaminated land.

The negative effects of air and soil pollution resulting from excessive emissions of industrial pollutants on cultivated plants and on animals are thus transmitted to man, a consumer of plant- and animal-derived products. Laboratory and field experiments indicate that plants have a differentiation of immunity to air pollutants. Regardless of the many factors affecting the immunity (or susceptibility) of a given species (or variant), immunity differs in relation to the individual components of air pollution. Here it should be remembered that this is relative immunity or susceptibility because various species or variants under identical conditions of exposure to a given toxic factor react in different ways and in a nonuniform manner with the accumulation of a toxic substance. The reasons for this differentiation have not been explained adequately to date. Thus, the method of using farmland is a relevant problem in the areas of ecological danger. To meet the increasing need for food, however, agriculture must continue to be intensified, but in a reasonable and fully controlled way.

The introduction of specialization in agriculture disturbed the balance in the agricultural ecosystem and caused problems in increasing the production of some animals for consumption on so-called industrial ranches. The concentration on ranches of hogs or cattle in one place is a tremendous burden on the ecosystem, and even an excessive load, especially on the soil and ground and surface waters. Almost all the giant ranches were realized without considering mulching technology, often without purification plants or even properly functioning reservoirs to store manure temporarily. In turn, the desire to maximize farming profit by growing more profitable plants, and at the same time neglecting to rotate crops to regenerate the land, is very dangerous for the ecosystem.

Pollution by agricultural wastes or the pollution of the soil by materials derived from the residues of heavy metals (as a result of the mechanization of work), especially mercury (namely as a result of treating seed grains with mercury for many years) and lead (from diesel engines), the intensive use of chemical fertilizers, pesticides and herbicides (together with the frequent nonobservance of precautions after using pesticides and herbicides), and the increasing pollution of the air, soil and water by industrial activity, disturb a plant's system for converting material, which in turn becomes toxic. The consumption of such plants over a long period of time causes chronic and often irreversible, fatal changes in people and animals. Field, forest and garden plants already react to small amounts of sulfur compounds in the atmosphere, and as the dosages of these compounds increase, plant life dies. It should be emphasized that this applies to all the basic plants that are essential to man and animals. The poisoning of the atmosphere also biologically degrades the forests, the natural producers of oxygen.

Table 5. The Structure of Crops in 1982 According to Groups of Agricultural Products (status in June)

Specification	Cereals ^a			Potatoes ^c	Industrial ^b		Fodder	All others ^d		
	Total	Including			Total	Including sugar beets		Total	Including Vegetables	
		Wheat	Rye							
In percentages of total crop areas										
Poland	56,1	10,1	22,7	15,1	6,0	3,4	16,4	6,4	1,6	
Areas of ecological danger, total	54,0	13,1	19,0	14,5	6,1	3,2	15,5	9,9	3,7	
Belchatow	63,9	1,5	46,2	21,8	0,1	—	10,4	3,8	1,4	
Biala Zaglebia	59,5	8,5	31,5	23,3	0,6	0,0	12,3	4,3	1,7	
Bydgoszcz-Torun	54,6	10,2	27,2	11,6	9,2	5,8	15,2	9,4	4,1	
Chelm	61,2	19,6	20,4	15,3	6,1	4,8	11,0	6,4	1,9	
Czestochowa	55,7	3,6	29,7	20,3	2,2	0,2	12,3	9,5	5,3	
Gdansk	49,6	11,3	14,2	9,7	6,2	2,3	24,0	10,5	3,3	
Upper Silesia	49,3	9,8	14,6	18,0	2,5	0,8	14,1	16,1	10,1	
Inowroclaw	52,9	14,8	12,0	8,6	14,2	9,8	13,6	10,7	1,6	
Jelenia Gora	51,4	13,3	6,1	15,0	1,9	0,0	23,8	7,9	4,7	
Konin	56,9	4,3	38,5	21,0	3,6	3,0	12,6	5,9	1,3	
Krakow	52,9	22,1	13,8	16,8	4,5	0,7	17,8	8,0	4,8	
Legnica-Glogow	55,0	19,2	10,9	8,3	11,0	7,6	13,4	12,3	2,3	
Lodz	55,5	3,0	34,3	19,0	0,7	0,3	15,2	9,6	3,7	
Myszkow-Zawiercie	58,0	10,9	18,3	15,3	8,5	0,3	8,9	9,3	6,4	
Opole	54,2	12,5	13,0	12,6	6,6	2,5	12,5	14,1	4,0	
Plock	56,6	12,7	26,4	12,9	7,9	7,3	18,4	4,2	2,3	
Poznan	54,6	4,1	29,9	13,3	5,4	3,0	10,7	16,0	7,7	
Pulawy	54,8	8,2	20,3	20,9	3,9	2,4	15,3	5,1	1,7	
Rybnik	55,7	14,7	17,7	18,7	2,2	0,8	14,1	9,3	4,4	
Szczecin	49,4	7,9	19,5	9,5	10,8	3,7	18,2	12,1	3,6	
Tarnobrzeg	57,6	12,3	23,3	19,5	1,3	0,6	17,1	4,5	1,7	
Tarnow	54,3	16,3	18,1	20,8	1,2	0,8	16,9	6,8	1,9	
Tomaszow	57,2	2,9	43,6	26,1	0,3	0,0	14,3	2,1	1,4	
Turoszow	59,9	17,1	14,5	9,7	5,8	0,9	16,0	8,6	1,6	
Walbrzych	51,4	14,8	6,5	13,9	3,4	1,2	19,6	11,7	6,7	
Wloclawek	52,7	11,2	25,2	11,9	12,4	9,4	14,2	8,8	3,1	
Wroclaw	45,9	16,3	8,0	9,1	10,9	4,7	14,0	20,1	9,0	
Areas not ecologically endangered	56,4	9,8	23,2	15,2	5,9	3,4	16,5	6,0	1,4	

a. Cereals: wheat, rye, barley, oats and all other cereals (oats with barley and other nonleguminous cereal mixtures, buckwheat, millet and other noncorn cereals).

b. Industrial crops: sugar beets, rape and rape oil, poppy seeds, sunflower seeds, linseed, hemp, tobacco, hops, medicinal herbs, red osier and other industrial crops.

c. Fodder crops: root crop tops, field peas, vetch, field beans; sweet lupines, mashlum and dredge corn, other feed mash, clover, pure alfalfa and sainfoin and mixed with grains, seradela, and other fodders and grasses.

d. All others: root vegetables, corn (together with flint corn) for seed and green crops, edible legumes (peas, lima beans, broad beans and others) and the remaining crops together with straw-berries, bitter lupine and root crops.

In 1982, the areas of ecological danger contained 1,888,300 ha of farmland including 1,427.9 ha of arable land [as published], 31,900 ha of orchards and 428,500 ha of grassland. Their share of the nation's resources was 10 percent, 9.8 percent, 11.8 percent and 10.5 percent, respectively. Only "all other utilized land and fallow land" represents a greater share of these areas, that is, 19.9 percent. This is the result of the large concentration of residential and industrial buildings, transportation networks, storage areas and the like.

The forests play a special role in improving ecological condition to intensify agricultural cultivation and to diminish the water-shortage threat. There are 901,000 ha of forests in the areas of ecological danger, that is, 10.4 percent of all the forestlands in Poland. Damaged standing timbers have been observed on about one-fourth of the forestlands in the areas under examination. The damage to standing timbers is especially severe on 19,500 ha, including 15,200 ha in the Upper Silesia area.

Within the areas of ecological danger, there was a total of 1,454,200 ha of crops sown in the given year. In the crop structure, cereals were dominant, encompassing 54 percent of the sown area, which is average for Poland as a whole; this was followed by fodder crops (15.5 percent) and potatoes (14.5 percent). The higher share of vegetables in many areas, especially in Upper Silesia (10.1 percent), Wroclaw (9 percent), Poznan (7.7 percent) and Walbrzych (6.7 percent), is noteworthy.

In 1982, 1,196,600 head of cattle (including 557,100 cows), 1,953,000 hogs and 431,000 sheep were bred in the analyzed areas. Relative to the total number of these animals bred in Poland, they represented 10 percent, 9.5 percent, 10 percent and 11.1 percent, respectively.

Among the areas of ecological danger, the Legnica-Glogow, Gdansk and Krakow areas had the largest shares of cattle (relative to the country as a whole); Legnica-Glogow, Krakow and Szczecin had the largest share of hogs, and Rybnik and Upper Silesia had the largest share of sheep.

The unfavorable situation for agriculture in Poland results from the fact that most areas of ecological danger contain farmland having the highest index of quality of productive agricultural land.¹ Only 7 of the analyzed areas are areas whose index of quality of productive agricultural land is lower than the national average, but 20 of the analyzed areas have an index of quality of productive agricultural land that is higher than the national average. The degradation of the environment in such areas as Krakow, Opole, Wroclaw, Pulawy, Gdansk (Zulawy), Legnica-Glogow and Tarnow, which are characterized by a high index of quality of productive agricultural land, is an especially severe loss for agriculture and the food economy.

1. "Poland's Productive Agricultural Land in Numbers," 1975, Institute of Cultivation, Fertilization and Soil Science, Pulawy.

Table 6. Farm Animals in 1982 (status in June)

Specification	Cattle		Hogs		Sheep
	Total	Including Cows	Total	Including Gilts for breeding	
Per 100 ha of farmland in units					
Poland	63.3	31.0	103.5	10.4	20.7
Areas of ecological danger, total	63.4	29.5	103.4	10.0	22.8
Belchatow	48.1	32.7	61.0	5.9	22.4
Biala Zaglebia	54.6	32.5	61.3	4.4	22.2
Bydgoszcz-Torun	62.9	26.8	135.5	12.3	17.8
Chelm	53.0	24.6	76.3	6.5	22.7
Czestochowa	66.3	28.4	131.3	8.3	26.8
Gdansk	71.9	29.8	86.3	8.9	12.6
Upper Silesia	54.7	23.5	100.0	9.0	34.7
Inowroclaw	65.3	27.8	125.9	13.7	42.2
Jelenia Gora	80.0	28.9	45.8	5.2	57.8
Konin	59.5	30.1	106.6	12.2	21.6
Krakow	61.4	39.1	92.1	9.5	17.0
Legnica-Glogow	70.2	26.0	118.8	12.0	13.4
Lodz	64.2	34.2	120.2	10.6	17.9
Myszkow-Zawiercie	36.7	19.3	54.2	2.7	27.2
Opole	81.5	30.9	141.6	12.8	21.9
Plock	54.1	30.6	138.9	13.5	10.9
Poznan	42.9	17.4	134.3	12.6	14.7
Pulaway	50.2	32.6	109.6	11.0	31.7
Rybnik	53.5	26.0	103.7	10.3	87.4
Szczecin	67.0	23.5	138.9	13.1	31.4
Tarnobrzeg	66.6	39.7	74.7	7.4	3.5
Tarnow	71.4	40.7	101.9	10.4	7.3
Tomaszow	59.3	39.8	87.7	7.7	38.0
Turoszow	56.2	22.3	73.4	8.2	24.5
Walbrzych	69.1	26.4	67.1	5.7	83.1
Wloclawek	62.9	28.1	99.3	9.9	11.1
Wroclaw	72.3	25.0	114.2	9.1	19.3
Areas not ecologically endangered	63.0	31.0	103.0	10.4	20.4

Thus, the opinion of some scientific circles that about one-fourth of the basic food products produced in Poland do not meet sanitary requirements is justified.¹

1. Material from the scientific-technical symposium entitled "The Effect of Air Pollutants on the Environment," NOT [Chief Technical Organization] Scientific-Technical Committee on Shaping and Protecting the Environment, Slupsk, 28-29 May 1979.

The extensive scientific literature devoted to the effects of environmental pollution on crops, farm animals and people indicates that:

- 1) Pollutants emitted into the atmosphere affect, directly and indirectly, plants, animals and people and cause a permanent distortion of the soil environment, negatively affecting the chemical properties of surface and subsurface water.
- 2) Systematic investigations should be conducted on the effects of air pollution on plant growth and yields, and on the content of harmful substances.
- 3) The tendency to form large plantations of orchards near facilities emitting heavy metal dusts, which are harmful to plants, mankind and animals, should be counteracted.
- 4) When developing on a regional basis, the research results obtained to date on the evaluations of relative immunity of specific crops to air pollution should be used.
- 5) Developing methods to counteract the degradation of the environment and the principles for agricultural-forest management in areas where the effects of pollution are severe should be among the most important tasks to be accomplished.

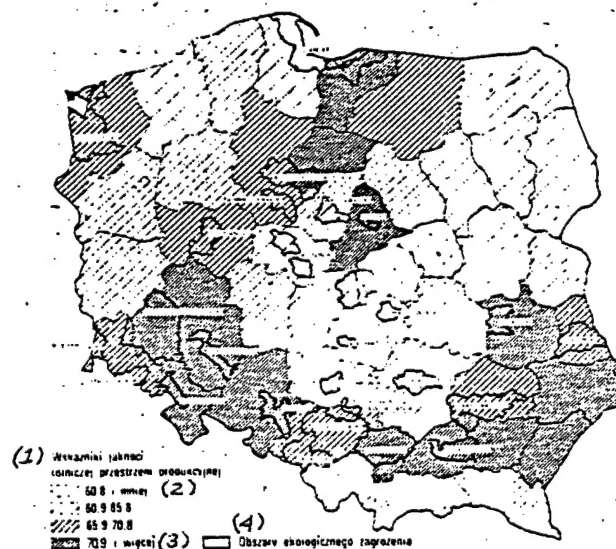


Figure 1. Areas of Ecological Danger Versus the Valorization of Productive Agricultural Lands in 1982

Key:

- (1) Indexes of quality of productive agricultural land
- (2) 60.8 and less
- (3) 70.9 and up
- (4) Areas of ecological danger

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